

National Climatic Data Center

DATA DOCUMENTATION

FOR

DATA SET 9712C (DSI-9712C)

Probability Levels for Freeze Dates and Growing Season Lengths

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National Climatic Data Center
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1. **Abstract:** The computation of the above statistics was performed for 3,240 stations in the United States (including Alaska and Hawaii) for the 1951-1980 period. The stations were selected from the 1951-1980 Climate Normals station list (DSI-9641). Spring and Fall freeze date distributions from TD9712b were then used to produce the freeze data and growing season lengths associated with specified probability levels (10, 20, 30, 40, 50, 60, 70, 80, 90 percent) presented in this data set (TD9712c). The low temperature thresholds were the values of 36, 32, 28, 24, 20, and 16 degrees Fahrenheit.

Data from the NCDC Summary of the Day (SOD) file (DSI-3200) were put through a vigorous quality control prior to producing the Freeze Data. The temperature data were put through extensive validation and interpolation procedures based upon the departure from the normal in conjunction with those from surrounding stations. As a result, the freeze data were produced from high quality, serially-complete station records of daily temperatures (Steurer, 1985). This alleviated the many possible biases or errors associated with developing freeze data statistics from an incomplete and lower quality data set. The serially complete data for the 1951-1980 period are archived in DSI-9641.

All freeze dates were based upon the season August 1 through July 31 for each threshold temperature. Last spring dates of occurrence were chosen for the period August 1 of the previous year through July 31 of the selected year (e.g., spring season for 1961 runs from August 1, 1960 through July 31, 1961, except 1951 which begins on January 1). First fall dates of occurrence were chosen for the period August 1 of the selected year through July 31 of the next year (e.g., fall season for 1961 runs from August 1, 1961 through July 31, 1962, except 1980 which ends on December 31).

The season definition is an improvement over that previously used when the selection of freeze dates was performed for data from the 1931-1960 period (DSI-9712a). During the 1931-1960 period freeze dates were selected using a six month season definition ending with June 30 for the last Spring freeze and beginning with July 1 for the first Fall freeze. The new season definition coincides more closely with the annual match of temperature in which the warmest time of year occurs close to August 1. The change of season definition produces more realistic dates in the extreme northern and mountainous regions of the United States where temperatures frequently are at the threshold temperatures near the June 30 date. However, it is important to note that the change of season definition should have no effect on other stations where temperatures do not reach or exceed the preselected temperature during the summer.

The estimation of freeze probabilities was based upon the work of H.C.S. Thom and R. H. Shaw which was later modified by C. K. Vestal. (See references). The selected probabilities were .1 through .9 in increments of .1. A date associated with each of the preselected probability levels was computed for the last spring and first fall freeze season. Similarly, the number of days associated with the freeze-free period was computed for each probability level. The probability levels represented the risk the user is willing to accept with regard to reaching or exceeding a certain threshold by a specific date or number of days. For example, suppose the .90 probability level for the spring season is computed to be March 1 at the 32-degree threshold. This means that nine times out of ten a temperature as cold as or colder than 32 will occur later than March 1 during the spring season. For the fall season, the probability level represents the chance of having a temperature as cold or colder earlier than the computed date. The freeze-free probability level indicates the chance of having a longer freeze-free period than the computed

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number of days.

This data file contains: 1. Probability levels of the occurrence of freezing temperatures within specified thresholds. 2. Number of years in which the specified threshold was reached or exceeded. 3. Mean (Julian) day number of occurrence associated with the specified threshold. 4. Standard deviation of mean Julian day number of occurrences found in item 3 above.

2. Element Names and Definitions: The data in this file are archived in a fixed length ASCII format. The total data volume is 3 megabytes. The data are sorted by the state number (ISTATE) as the primary key followed by station number (ISTATN), freeze season, (IFRZSN), and freeze threshold (IFRZTH-descending) as secondary keys.

Element	Type	Width	Start Column	End Column
ISTATE	Integer	2	1	2
ISTATN	Integer	4	3	6
IDIV	Integer	2	7	8
IFRZTH	Integer	2	9	10
IFRZSN	Integer	1	11	11
IPROB(1)	Integer	4	12	15
IPROB(2)	Integer	4	16	19
IPROB(3)	Integer	4	20	23
IPROB(4)	Integer	4	24	27
IPROB(5)	Integer	4	28	31
IPROB(6)	Integer	4	32	35
IPROB(7)	Integer	4	36	39
IPROB(8)	Integer	4	40	43
IPROB(9)	Integer	4	44	47
INMYR	Integer	2	48	49
RMNJL	Real	4	50	53
RSTDJL	Real	5	54	58

Element Name	Element Definition
ISTATE	Characters 1-2 Cooperative State Code Number Range 01-48, 50, and 51.
ISTATN	Characters 3-6 Cooperative Station Code Number Range 0001-9999
IDIV	Characters 7-8 Cooperative Division Code Number Range 01-10
IFRZTH	Characters 9-10 These are the threshold temperatures used in determining the specific probability levels of the last Spring, first Fall, and growing season lengths. They are expressed in Fahrenheit degrees. The values are 36, 32, 28, 24, 20, and 16.
IFRZSN	Character 11

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	<p>This is the freeze season indicator code.</p> <p>1 = Last Spring Freeze</p> <p>2 = First Fall freeze</p> <p>3 = Growing season length</p>
PROBABILITY-LVL-.10 IPROB(1)	<p>Characters 12-15</p> <p>Read Topic 21 for an explanation of freeze probability levels. This data field represents the 10 percent probability level. Range of values in this field and IPROB(2)-IPROB(9) is determined by the Freeze Season Code in character 11. If the freeze season code is the last spring or first fall freeze, the four digit value contains a specific date of occurrence(month and day) Range of values is 0101-1231 and 0000.</p> <p>If the Freeze Season Code is growing season length, the four digit value represents an accumulated day number. Range 0000-0365, and 9999.</p> <p>Note: A "9999" growing season length indicates > 365 days. A "0000" spring and fall freeze indicates that the probability of occurrence of the threshold temperature is less than the indicated probability.</p>
PROBABILITY-LVL-.20 IPROB(2)	<p>Characters 16-19</p> <p>See definition of IPROB(1) above. This data field represents the 20 percent probability level. Range explained in characters 12-15.</p>
PROBABILITY-LVL-.30 IPROB(3)	<p>Characters 20-23</p> <p>See definition of IPROB(1) above. This data field represents the 30 percent probability level. Range explained in characters 12-15.</p>
PROBABILITY-LVL-.40 IPROB(4)	<p>Characters 24-27</p> <p>See definition of IPROB(1) above. This data field represents the 40 percent probability level. Range explained in characters 12-15.</p>
PROBABILITY-LVL-.50 IPROB(5)	<p>Characters 28-31</p> <p>See definition of IPROB(1) above. This data field represents the 50 percent probability level. Range explained in characters 12-15.</p>
PROBABILITY-LVL-.60 IPROB(6)	<p>Characters 32-35</p> <p>See definition of IPROB(1) above. This data field represents the 60 percent</p>
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	probability level. Range explained in characters 12-15.
PROBABILITY-LVL-.70 IPROB(7)	Characters 36-39 See definition of IPROB(1) above. This data field represents the 70 percent probability level. Range explained in characters 12-15.
PROBABILITY-LVL-.80 IPROB(8)	Characters 40-43 See definition of IPROB(1) above. This data field represents the 80 percent probability level. Range explained in characters 12-15.
PROBABILITY-LVL.90 IPROB(9)	Characters 44-47 See definition of IPROB(1) above. This data field represents the 90 percent probability level. Range explained in characters 12-15.
INMYR	Characters 48-49 This field contains 2 digits representing the number of years in which the specified freeze threshold was reached or exceeded. Range 00-30.
RMNJL	Characters 50-53 This 4-digit field contains the mean Julian day number of occurrences associated with a specific threshold. (implied 1 decimal). Season begins August 1 and ends July 31 of the next year. (E.g., Julian day number is 1.0 for August 1 and 31.0 for August 31). Range 0000-3660.
RSTDJL	Characters 54-58 This 5 digit field contains the standard deviation of the mean Julian day number of occurrences found in characters 50-53. Range 00000-99999 (implied 2 decimals).

3. **Start Date:** 19510101

4. **Stop Date:** 19801231

5. **Coverage:** the contiguous United States, Alaska and Hawaii

Southernmost Latitude: 18N
 Northernmost Latitude: 65N
 Westernmost Longitude: 160W
 Easternmost Longitude: 65W

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6. How to Order Data:

Ask NCDC's Climate Services about the cost of obtaining this data set.
Phone: 828-271-4800
FAX: 828-271-4876
E-mail: NCDC.Orders@noaa.gov

7. Archiving Data Center:

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, NC 28801-5001
Phone: (828) 271-4800.

8. Technical Contact:

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, NC 28801-5001
Phone: (828) 271-4800.

9. Known Uncorrected Problems: There are no known uncorrected problems in this data set.

10. Quality Statement: Data from the NCDC Summary of the Day (SOD) file (DSI-3200) were put through a vigorous quality control prior to producing the Freeze Data. These temperature data were put through extensive validation and interpolation procedures based upon the departure from the normal in conjunction with those from surrounding stations. As a result, the freeze data were produced from high quality, serially-complete station records of daily temperatures. This alleviated the many possible biases or errors associated with developing freeze data statistics from an incomplete and lower quality data set. The serially complete data for the 1951-1980 period are archive in DSI-9641.

11. Essential Companion Datasets: The use of NCDC's Station History file (DSI-9767) is required in order to determine metadata on each station (name, location, elevation, etc.). This can be accomplished by comparing the station number in bytes 1 through 6 of this data set with the corresponding station number in the Station History data set. There is also a significant derived application of this data: One of the more significant applications of this data set is in agriculture, where late spring freezes, early fall freezes and short growing seasons can seriously impact plant production and crop volume. Various agricultural applications use these probability data for planning purposes. For each station, selected probability levels from this data set were published in the book "Freeze/Frost Data" and also used in the generation of freeze probabilities maps available in the Climatology of the US No. 20 (See references). These are also available on microfiche.

Graphs of the 32 degree Fahrenheit probability distribution of the last Spring and first Fall freezes are depicted with cumulative daily growing degree day units for bases of 40, 45, 50, 55, and 60 degrees Fahrenheit. These graphs are for individual climate stations for the 1951-1980 period and are available

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on microfiche.

12. References:

Environmental Information Summaries C-26 - Climatology of the United States Number 20, National Oceanic and Atmospheric Admin., NCDC, Asheville, N.C.

Koss, W.J., Owenby, J.R., Steurer, P.M., and Ezell, D.S., 1988: Freeze/Frost data, Climatology of the U.S. No. 20, Supplement No. 1. Nat. Oc. And Atmospheric Admin., NCDC, Asheville, N.C. 186 pp.

Steurer, P.M., 1985: Creation of a serially complete data base of high quality maximum and minimum temperatures. Unpublished document, NOAA, National Climatic Data Center, Asheville, NC, 21 pp.

Thom, H.C.S., and Shaw, R. H., 1958: Climatological analysis of freeze data for Iowa. Monthly Weather Review, 86, 251-257.

Thom, H.C.S., 1959: The distribution of freeze-date and freeze-free period of climatological series with freezeless years. Monthly Weather Review, 87, 136-144.

Vestal, C. K., 1971: First and last occurrences of low temperatures during the cold season. Monthly Weather Review, 99, 650-652.